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Institutes for Research Work in the Interest of Agriculture in the Netherlands Indies

By DR. P. J. S. CRAMER

Director, Experiment Station, Department of Agriculture, Netherlands Indies, Buitenzorg, Java.

Delegate to First Pan-Pacific Food Conservation Conference.

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Institutes for Research Work in the Interest of Agriculture in the Netherlands Indies

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EDITORIAL NOTE

Dr. P. J. S. Cramer's comprehensive paper on the Institute for Research Work in the Interest of Agriculture in the Netherlands-Indies, presented in this issue of the Journal, is the outgrowth of Resolution XIII passed at the Pan-Pacific Food Conservation Conference held in Honolulu, July-August 1924, which reads as follows:

RESOLUTION XIII.

Resolved, That the First Pan-Pacific Food Conservation Conference recommend the various governments of the countries bordering the Pacific that there be prepared and sent to the organizers of the Pan-Pacific Science Congress to be held in Japan in 1926, a comprehensive list of the individuals, institutions, and agencies engaged in research, extension work, or advanced educational work pertaining to useful products of the sea and of the soil, or those branches of science related thereto (such as: ichthyology, marine biology, oceanography, economic entomology, plant pathology, agronomy, animal husbandry, genetics, agricultural geography, meteorology, agricultural chemistry and agricultural bacteriology); and that this list be supplemented by a brief resume of investigations in the aforesaid branches which have been completed, are now in progress, or are contemplated.

In submitting his paper, Dr. Cramer states that it was prepared at the instance of the Director of Agriculture, Industries and Commerce, and with the collaboration of the directors of the various experiment stations and similar institutions of the Netherlands-Indies. That the work was well done and must prove of much value to research workers of Pacific lands all will agree. It is the hope of the editors that more such contributions will follow in rapid succession so that by the end of the year we may list practically all of the research institutions and their personnel of the countries bordering the Pacific and in due time extend the field well beyond.

1. INTRODUCTION

The organisation of research work in agriculture in the Netherlands Indies has followed different lines. Out of a botanical garden with a small scientific staff developed a department of agriculture, industries and commerce, which, as a government institution endeavors to stimulate these branches of human activity and to improve their results. It contains several bodies for research work, f. i. a botanical garden, an agricultural experiment station, a veterinary experiment station, a phytopathological institute and a forestry experiment station. On the other hand some related subjects are confined to other departments; the development of irrigation projects is mainly in the hands of the public department, and the meteorological observatory forms part of the navy department.

The department of agriculture contains, besides the institutions for research work, administrative services, like the forestry and the veterinary service, several schools for agriculture, for training native veterinary officers; further, a division for work in connection with industries and a division of commerce. It comprises also a large number of agricultural officers, one in every province, to advise the native population in agricultural matters; they may be compared with the farm advisers in the U. S.

Besides these government bodies very important experiment stations have been organized for special crops by the planters interested in those. They are supported entirely by private means, collected from the plantations interested by free subscription.

A few experiment stations form part of the organization of large plantation companies. No obligatory organization controls the efforts of these various institutions. They are independent from the government and independent among themselves. Once a year the members of their scientific staff come together in a conference and a satisfactory cooperation between them is obtained by these meetings. It is planned now to reorganize the stations working in Java for rubber and some smaller crops, like tea, coffee, and cacao, and to bring them together into one large organization.

We may say, that we find every form and size of institution, from the one started by the government with public money for the use of the whole community, to the highly specialized private institute, supported by a large plantation company and concentrating its efforts to raise the profits for the company's capital engaged in the plantation.

In connection with these different forms the scope of the work is also different. The Sugar Experiment Station at Pasoeroean, supported entirely by the private sugar companies, is probably the world's largest institution of its kind, concentrated on one single crop. It has not only central divisions for studying the agricultural problems of cane production, for the improvement of the chemical and mechanical processes involved in the industry, but also a set of agents scattered over the principal cane growing districts, linking up the local planter with the central station. The private stations for other crops, like rubber and coffee, have often a local significance, helping the planters in their province, but doing also research work. Sometimes, when a serious danger forms a problem of vital importance for a crop, like the beetle borer of coffee berries, all the interests concerned unite to form together a special fund and to organize the research work in a special project.

In this way the research work in the Netherlands Indies may be said to have adapted itself all the time to the special needs of the moment and of the interests involved.

The following list gives the research men in the different experiment stations and related institution, a few out-

lines of the problems on which they work, and their publications.

2. GOVERNMENT BOTANICAL GARDENS.

BUITENZORG.

This garden was established in the year 1817 and under the old name of " 's Lands Plantentuin" different institutions for purely scientific research are combined. The chief aim is to promote the study of natural history in these countries, not only through the work of its own staff but also by offering opportunities for study in different laboratories to scientific workers from abroad.

Director: Dr. W. M. Docters van Leeuwen; small scientific and clerical staff.

1. *Laboratory and office of the director.*
Studies on galls and plant-biology in general. New flora of Krakatau.

2. *Treub-laboratory.*
Chief: Dr. F. C. von Faber. Plantphysiology, especially mangrove- and crater-plants.
Assistant: Ch. Coster. Plant-physiology, especially of trees.
In this laboratory six tables for foreign botanists are available.

3. *Herbarium and Museum for systematic botany.*
Chief: Dr. J. G. B. Beumée. Plant-taxonomy in general.
Assistants: R. C. Bakhuizen van den Brink. Verbenaceae, Bombacaceae.
Dr. D. F. van Slooten. Flacourtiaceae, Combretaceae, Dipterocarpaceae, Gramineae.
Dr. H. J. Lam. Verbenaceae, Sapotanceae, Burseraceae.
Dr. C. van Overeem. Fungi and Lichenes.
Dr. B. H. Danser. Polygonaceae, plant-geography.
Conservators: Mrs. M. C. Lang and Mrs. F. F. N. Terlaak.

4. *Botanic Gardens at Buitenzorg, altitude 250 M., about 80 H. A.*
Chief Gardener: H. J. Wigman.

5. *Botanic Gardens at Tjibodas, altitude 1,500 M., about 20 H. A.*
Assistant Gardener: M. L. A. Bruggeman.
Annexed to this mountain-garden there is a nature reservation of about 1200 H.A., enclosing the summits of Mount Cedeh and of Mount Pangerango, 3000 M. elevation. In the gardens there exists a guests' house and a laboratory and in the forest at an elevation of 2400 M. there is a small house for the students of the alpine flora.

6. *Botanic Gardens at Sibolangit (near Medan in East Sumatra), altitude 500 M. about 20 H. A.*
Assistant Gardener: J. A. Lörzing.
Annexed to this garden there is a nature reservation of about 300 H. A.

7. *Zoological Museum and Laboratory.*
Chief: Dr. K. W. Dammerman. Zoogeography and research of the new fauna of Krakatau.
Assistants: Dr. H. H. Karny. Entomology, Orthoptera, Thripsidae, Psocidae, Psyllidae. H. C. Siebers. Ornithology. Taxidermist. P. Franck.

8. *Laboratory for marine investigations and Aquarium.*
Chief: Dr. H. C. Delsman. Studies on the embryology of fishes.
In this laboratory there is a strangers' working-room for foreign guests, with five tables.
Research vessel: "Dog," Captain H. L. Claessen, and motor boat: "Max Weber."

9. *Phytochemical Laboratory. Temporarily closed.*
The publications of the Gardens are:
1. Annales dus Jardin Botanique de Buitenzorg. Printed by E. W. Brill, Leiden, Holland. Chiefly containing articles on plant-physiology and anatomical and biological subjects.
2. Bulletin du Jardin botanique de Buitenzorg. Printed in Batavia. Chiefly containing articles on systematic subjects.
3. Treubia. Receuil de travaux zoologiques, hydrobiologiques et océanographiques. Printed in Batavia.
4. Icones Fungorum Malavensium, Abbildungen und Beschreibungen der Malayischen Pilze, edited by Dr. C. van Overeen and Prof. Dr. J. Weese.
5. Handboek voor de Flora van Java, by C. A. Backer.
6. Guides to the gardens and seed catalogues.

3. GENERAL AGRICULTURAL EXPERIMENT STATION.

BUITENZORG.

The aim of the institute is to bring together scientific and technical knowledge, the appliance of which leads to the improvement of crop production, however with the exception of phytopathological and meteorological work. It does partly general work (f. i. in soils and plant introduction) and also some more specialized work for native crops, as these have not, like the large plantation crops like sugar cane, rubber, etc. their own experiment stations.

Director: Dr. P. J. S. Cramer; small clerical staff.

1. *Laboratory for research work on soils.*
Chief: Ir. J. Th. White. Physical analysis of soils. Chemical analysis of different fractions of soils. Reactions of soils of known constitution on manures. Volcanic ashes. Atterberg figures. Classification of soils of newly explored regions in relations to crop production.
Assistant: Dr. E. E. Scheibener. Petrographical survey of Java in tracing the origin of the soils. Mineralogical analysis of soils. Fossils.

2. *Laboratory for Microbiology.*
Chief: J. Groenewege. Bacteriology of the soil. Fermentation process; silage. Biological purification of water.

3. *Chemical laboratory.*
Chief: Dr. C. van Rossem. Analyses of chemical constitution of crop plants at different stages of development. Experiment with chemical fertilizers for native crops.
Assistant: F. W. Weber. Chemical analysis of food plants, green manures, fertilizers, irrigation water, soil samples.

4. *Botanical laboratory.*
Chief: Dr. P. van der Elst. Physiology of rice plant. Agrometeorology. "Mentek" disease=root rot of rice. Influence of external factors, planting time, lack of necessary mineral plant foods, weather conditions on failure of crops.

5. *Section for Agronomy.*
Acting Chief: Ir. A. Wulff.

Field experiments, testing different varieties, different treatments. Technique of native crop production.

Agricultural implements. Plows and tools, adapted to native and plantation crops and different kinds of soils.

6. *Section for Plantbreeding of permanent crops.*
Chief: Dr. P. J. S. Cramer. Introduction of wild forms and allied species of cultivated plants. New species of Hevea, coffee, kapok, etc. New crops. Experiments on grafting, influence of stock on scion with tropical crops (coffee, rubber, etc.)
Assistant: H. de Veer. Selection of coconuts. Varieties of oil palms.
The experiments are carried out in two gardens:
(a) Economic Garden, Buitenzorg. W. M. van Helten, manager.
± 20 H.A. Green manures from a practical point of view. Production of seed and planting material of economic plants and new crops.
(b) Experimental coffee plantation, Bangelan, near Malang.
F. A. Parkinson, manager. 200 H.A. of different species, hybrids and clones of coffee.

7. *Section for Plantbreeding of annual crops.*
Chief: L. Koch. Seed selection of rice, corn and other native crops. Introduction of new varieties. Experiments with new forage and fibre plants. Seedling selection with cassave (Manihot). Production and distribution of better planting material.
Assistant: Dr. I. Boldingh. Varietal character of rice. Ear to row experiments with corn.
(a) Experiment garden, Buitenzorg (20 H.A.)
(b) Seed production garden, Buitenzorg. (28 H.A.)
The publications of the Station are two:
(1) Mededeelingen van het Algemeen Proefstation voor den Landbouw (Bulletin).
(2) Korte Berichten, uitgaande van het Algemeen Proefstation voor den Landbouw (Circulars: they are also published in "Algemeen Landbouwweekblad", Bandoeng, Java).

4. INSTITUTE FOR PLANT DISEASES.

BUITENZORG

The work of the Institute for Plantdiseases consists in research work regarding diseases and noxious animals attacking crop plants and the control of imported plants. (Plant Quarantine Service).

As the investigation of plant diseases and insect pests of plantation crops forms part of the work of the Experiment Stations, the Institute for Plant diseases can confine itself principally to the investigation of some important questions regarding diseases and pests of plantation crops.

The Plant Quarantine Service inspects all the living plants and parts of living plants (inclusive seeds, fruit, bulbs, cuttings, etc.) from abroad. Fruit is inspected in the harbors Tandjong Priok, Semarang, Soerabaja, Makassar and Medan (Belawan), plants only in Tandjong Priok and Medan (Belawan).

Director: Dr. C. J. J. van Hall; small clerical staff.

1. *Zoological Laboratory.*
Chief: S. Leefmans.
Entomologists: Dr. P. van der Goot; Ir. L. Kalshoven.
Mr. Leefmans is especially working on coconut pests, fruit tree insects and in-

sects of stored products; Dr. van der Goot on insects of the rice plant, potato-pests, pests of leguminous plants; Mr. Kalshoven on insects of forest trees and wood insects.

2. *Botanical Laboratory.*

Chief: the Director of the Institute.

Botanist: Dr. Bea M. Schwarz.

Miss Schwarz is presently busy with the study of the bacterial disease of the peanut and its control by means of selection of resistant strains, the study of potato-diseases and the study of some diseases of forest trees.

3. *Plant Quarantine Service.*

Chief: the Director of the Institute.

Zoologist: Mr. W. C. van Heurn.

In Tandjong Priok a special Quarantine officer is stationed; in Semarang, Soerabaja, Makassar and Medan the inspection work is done by the Agricultural advisers. In Medan the private Experiment Station collaborates in this work.

Publications: Mededeelingen van het Instituut voor Plantenziekten.

5. AGRICULTURAL ECONOMICS. BUITENZORG.

This division serves two purposes: at one side, it analyses the factors influencing crop production to make out what they mean in the cost of production, on the other side it explores the new or little opened parts of the archipelago to examine the factors existing there and to see how conditions can be improved to attract capital towards these regions. Since 1921 the division was in charge of a government aid bank to help plantations, suffering from the crisis, through the bad years. In late years a good deal of attention has been paid to the study of native rubber productions, its present state and future.

Difficulties to recruit a suitable staff have kept back the development of this division. Since the departure of Dr. Pekelharing it is put in charge of Dr. P. J. S. Cramer, as acting head.

No series of publications is issued. Various reports of Dr. Pekelharing were published by the Department. A series of reports on the native rubber production is published now in collaboration with the Native Rubber Investigation Committee.

6. GOVERNMENT CINCHONA EXPERIMENT STATION.

(Situated at the Government Cinchona Plantations, Tjinjiroean, Pengalengan, near Bandoeng).

The work of this station contains:

1. Making of commercial and agricultural analyses of cinchona-bark.

2. Sending out advice regarding cinchona culture.

3. Doing research work, chemical, botanical and agricultural to improve cinchona culture.

The personnel comprises:

Director: Dr. M. Kerbosch.

Botanist: Dr. C. Spruit P. Pzn.

Chief Analyst: W. van Dorssen.

Analyst: E. van der Tas.

Agricult. Assistant: P. Schrijnen.

The publications of this station are:

(1) Mededeelingen van het Gouvernements Kina Proefstation.

(2) Cinchona. A periodical, devoted to cinchona culture, appearing twice a year.

7. COLLEGE OF AGRICULTURE, BUITENZORG.

(Middelbare Landouwschool)

The school trains young men of all races for the higher positions in agriculture. For admission a successful preparation in a Mulo-school or the first three classes of a high school is required. Most of the pupils go to private estates; besides these a few native pupils are trained for the position of assistant-Inlandsch landbouwleeraar (comparable with farm adviser). They are trained under contract; they have to remain 5 years after their training in Government service and receive, besides free training, a monthly allowance. Further, young men can be trained for the Government

Forestry Service, but this training is only put into working, when this service requires new rangers.

Director: Dr. Th. Valeton.

8. FOREST RESEARCH INSTITUTE.

Buitenzorg, Java.

The aim of the Institute, which is a subdivision of the Forest Service, is the investigation of both the scientific and the technical problems that occur in forest management.

Director: Dr. R. Wind; clerical staff.

1. *Section of wood technology.*

Chief: Dr. L. G. den Berger.

Assistant: Forest Officer A. Th. J. Bianchi.

Identification of tropical woods with a pocket lens; investigations on the mechanical, physical, and chemical properties, the microscopic structure, the durability, seasoning and preservation of wood; rules for the inspection of timber; grouping of the different woods in durability—and value classes (in collaboration with the section for botanical and wood technical exploration); distribution of authentic wood samples, investigation on minor forest products; extension service.

2. *Section for botanical and woodtechnical exploration of forests.*

Chief: Forest Officer F. H. Endert.

Assistant: Forest Officer A. Thorenaar.

Collecting of botanical material and authentic wood samples of the principal trees of the Archipelago; collecting of data about range, frequency and vernacular names of these trees and about the uses and the durability of the wood.

3. *Section for the investigation on the regeneration of the different kinds of trees, except teak.*

Chief: Forest Officer A. Noltee.

Investigation on the regeneration of the most important kinds of trees, except teak, for industrial purposes, for the production of tanning material, etc.; investigation on the selection cutting systems in mountain-forests; distribution of seeds.

4. *Section for the investigation on the regeneration of teak and forest protection.*

Chief: Forest Officer H. M. J. Hart.

Assistant: Forest Officer J. P. Schuitemaker.

Sylvicultural investigation on the regeneration of teak and its principal associates. Forest protection against fires, cattle and different diseases.

5. *Section of thinnings- and yield-capacity.*

Chief: Forest Officer H. E. Wolff von Wülfing.

Assistants: Forest Officers J. A. J. H. Stoutjesdijk and F. W. K. de Klerk.

Investigation on the yield of timber and financial produce of teak and other trees. Methods of measuring crops and increment, modes of treatment, calculation of yield-tables, etc.

Publications (the first may be called a bulletin, the second a circular):

1. Mededeelingen van het Proefstation voor het Boschwezen.
2. Korte Mededeelingen van het Proefstation voor het Boschwezen.

9. LABORATORY FOR VETERINARY RESEARCH.

BUITENZORG.

This Institute, which was founded in the year 1908, is dealing with the investigation of various infectious cattle diseases occurring in the Dutch East Indies and with the different problems relating to them. It produces vaccines and sera against several of the above mentioned diseases as well as verified products for diagnosing some of them.

The laboratory is separated from the organization of the Civil Veterinary Service, although it acts as a bureau of advice as far as the combating of scheduled diseases is concerned.

The bulk of the products is sent to the Veterinary Government officials in the country districts, whilst only a limited quantity is used by the Military Veterinary Service and by private cattle raisers.

Director: C. Bubberman, D. Vsc.; small clerical staff; two overseers; a number of native laboratory and stable attendants.

A. Section for general diagnosis.

Chief: J. B. Douwes, D. Vsc., who is

specialized in veterinary protozoölogy. Examination of pathological material forwarded by the government officials, such as bloodsmears, tissues, cultivation of pathogenic organisms; precipitation test in judicial cases, a. s. o. Experiments concerning the study of parasitic blood diseases, such as surra, piroplasmosis, anaplasmosis. At present experiments are running on the possibility of establishing an immunity in anaplasmosis by means of a South African strain of anaplasma and on the treatment of surra in horses with the combined method of naganol and atoxyl.

Subsection for routine work, such as staining of smears, cutting of sections, controlling of culture-media a. s. o.

Assistant: R. Djaenoedin, qualified native-veterinarian. During the year 1924 this section examined material from 410 cases.

B. Section for glanders, tuberculosis and serological diagnosis.

Chief: L. W. W. Lobel, vet. surgeon; two analysts for the routine work. Preparing of malleine and tuberculine; centralized administration of the record of the malleine and tuberculine tests done by the Government officials; sero-diagnosis (complementfixation and conglutination) of glanders, as well as of contagious abortion (agglutination and complementfixation). Experiments regarding the sero-diagnosis of tuberculosis.

During the year 1924 a total of 1493 sera were tested, whilst a quantity of 16.113 cc. malleine and of 14.237 cc. tuberculine was sent to the veterinary surgeons.

C. Section for the preparing of controlled antisera and vaccines.

Chief: F. L. Huber, D. Vsc.; one qualified native-veterinarian as assistant.

Preparation of antisera against haemorrhagic septicaemia in the buffalo, anthrax, blackleg, fowl cholera, swine plague and of vaccines against haemorrhagic septicaemia in the buffalo, anthrax (spores-vaccine), blackleg (aggressin), fowlcholera.

Experiments on the making of a vaccine against avian diphtheria. Controlling of field experiments with regard to sero- and vaccine-prophylaxis. Preparing of auto-vaccines.

The output of some of the products during the year 1924 ran up to an amount of:

Haemorrhagic septicaemia in the buffalo.	serum	452.525 cc.
	vaccine	141.770 cc.
Anthrax	serum	283.795 cc.
	vaccine	7.810 cc.
Blackleg	serum	104.200 cc.
	germfree filtrate	718.990 cc.

D. Section for economical veterinary Zoölogy.

Chief: Dr. O. Ch. F. Nieschulz, Zoologist.

Determination of internal and external parasites. Studying the biology of surra-transmitting insects (principally of tabanids), as well as of the transmission-act itself.

E. Section for miscellaneous research.

Chief: F. C. Kraneveld, vet. surgeon.

Research-work with regard to different problems which do not belong to one of the other sections, f. i. at present on a typical disease among bullocks on the tobacco-estates in Sumatra, showing symptoms of joint-inflammation.

The Laboratory publishes a bulletin called:

Veeartsenijkundige Mededeelingen van het Departement van Landbouw, Nijverheid en Handel.

10. *ROYAL MAGNETIC AND METEOROLOGICAL OBSERVATORY, BATAVIA.*

Dr. C. Braak, Director.

Dr. J. Boerema, Sub-Director.

Dr. S. W. Visser and Dr. H. P. Berlage.

Magnetic Observations. Self-recording instruments and eye-readings, partly at Batavia, partly at Buitenzorg. Magnetic survey of the Archipelago. A publication about the isomagnetic lines in 1925, by Dr. Visser, is in preparation.

Meteorological Observations. Rainfall observations of about 3000 stations in the Archipelago are regularly sent in at the Observatory and are tabulated to serve as a source of information. Moreover, the results are regularly published in monthly and annual publications.

Observations with self-recording raingauges have been made at about 40 stations, the greater part of which is still in operation.

A rainfall atlas of Java, with monthly and annual charts, prepared by Dr. Boerema has just appeared.

Moreover Dr. Boerema has finished a treatise about the distribution of rainfall in heavy showers; a treatise about the distribution of the annual variation of rainfall is in preparation.

Observations of temperature, humidity, sunshine and other meteorological elements are made at a number of stations, distributed over the whole Archipelago. They serve as information, and are moreover, being compiled in a convenient form by Dr. Braak in a treatise about the Climate of the Netherlands Indies, of which the first volume, containing the general chapters, has been completed.

A forecast for Java about the rainfall in June-October is given every year. Dr. Berlage is now in charge of this work.

Observations of the intensity of sunshine have been made by Dr. Boerema during several years at various places. Measures are being taken to complete the installation with instruments for the observation of the radiation in the separate parts of the spectrum.

Seismological Observations. Earthquakes are being recorded by two horizontal Wiechert pendulums of 1000 Kg., one at Batavia and one at Ambon. Besides these large seismographs a smaller one is recording at Malabar (West-Java) and, furthermore, small seismographs are established on the active volcanoes Merapi and Papandajan, with the purpose of studying the possibility of a forecast of the eruptions.

A treatise on the distribution of earthquakes in the Archipelago has been published by Dr. Visser.

Dr. Visser is also in charge of the collecting and publication of reports about volcanic action and earthquakes in the Archipelago.

Other observations, made and collected by the Observatory, are:

Observations of wind, temperature and humidity in the higher air layers, for scientific purposes and on behalf of aviation.

Observations of sea tides and sea currents, tide tables for several harbors being calculated and published.

Time observations, a wireless time signal being given every morning by the powerful radio station of Malabar.

A list of publications of the Observatory is given in the Introducation to the annals of the Observatory: "Observations made at the Royal Magnetical and Meteorological Observatory at Batavia."

11. SUGAR EXPERIMENT STATION AT PASOROEAN.

The station is supported entirely by private sugar companies, forming an association, members of which can be solely owners of sugarmills. Nearly 90 per cent of all the factories in Java are members. An administrative board is formed by representatives of the larger sugar companies; at the head of the Station is placed a Director, acting in cooperation with the Board.

The institute is occupied with the study of all parts of the sugar industry, as well of the agricultural work as of the engineering and chemical work; the economical concentration in the Java Sugar industry makes it possible to at-

tain this high concentration in research work.

In the station are three departments: an agricultural, an engineering and a chemical one, led by one director. An effective control over the agricultural work is possible in Java, because the factories plant their own cane; cane farming is an exception in Java.

The aim of the research work may be summarized in this simple formula: it tries to find optimal conditions for each sub-division of the process of planting cane and making sugar from this cane, hence from the moment of preparing the soil to that of shipping the sugar. The organization to fulfill this work is the following: The director and assistant-director lead the work and distribute the problems and questions sent in by members under the different specialists, doing the laboratory research work; they also write the advices or control the advices given by specialists for the factories. The central station uses fifteen group-advisers for her connection with the factories, which are spread over an area measuring from West to East 700 km. These group-advisers are agricultural officers, each living in the center of a group of factories, containing a number of 10 to 20 factories; they do the daily advising work, have the supervision over field experiments laid out at the factories, bring the results of research work of the central station to the managers and overseers and procure to the central station the knowledge of practice necessary for studying the general problems. A member always is entitled also to ask the visit of a specialist of the central station, if necessary for a special question.

In the agricultural department the research work is concentrated on the following points:

Study of the caneplant from botanical and taxonomical point of view, outer and inner morphology, cytology and genetics of cane; breeding of new varieties; study of the soil, making of agrogeological maps of factories; field trials for finding the best variety for each type of soil and for fixing optimum conditions for manuring, time of manuring, methods of planting, of cultivating the soil, of irrigating the fields a. s. o.; study of climate, record of sunshine and rainfall; study of diseases and pests; collecting of statistics on rainfall, milling results, yield of different varieties on each plantation.

The engineering department controls in the first place the milling plant and studies the principles of milling machinery; it is also occupied with the study of furnaces, boilers, centrifuges, pumps, all apparatus used in the factory; it gives advices on steam and fuel-economy, right position of millrolls; a mutual control is published fortnightly on these points in which almost all factories take part. The work has the general aim to diminish the losses in bagasse and to run the factory in the most economical way.

The chemical department studies the losses in sugar from the moment the juice flows from the first mill to the moment the sugar leaves the factory; it studies especially the clarification, the evaporating plant and the boiling process. This department acts as arbitrator in questions about quality of delivered sugar.

The association publishes a weekly journal, the "Archief voor de Javan-Suikerindustrie," in the Dutch language, in which journal also appears the "Mededeelingen van het Proefstation," publication on the studies, executed by the staff of the experiment station, which are sent to the more important institutes in the world in exchange for their issues.

Half-monthly records are published of the rainfall on all the Java factories; of the average yield per bouw during the milling season; the mill-control, fuel-control and fabrication-control are also published half monthly; a monthly record is given of the hours of sunshine on a

number of factories regularly spread over Java.

The staff of the Station is formed by 45 Europeans, 4 Chinese and about 130 natives.

Director: Dr. Ph. van Harreveld, general organization.

Assistant-Director Dr. J. Kuyper, head of agricultural department.

Secretary: J. van Harreveld, editor of the "Archief voor de Java-Suikerindustrie"; head of statistical work.

Administrative staff: Bookkeeper, librarian, archivist.

1. *Section for cane breeding and botany of cane.*

Dr. O. Posthumus (successor to Dr. J. Jeswiet) outer morphology of cane, taxonomy of Saccharum, identification methods of cane varieties.

Dr. J. P. Bannier, studies in cane genetics, breeding of new varieties, anatomy and morphology of cane.

Dr. G. Bremer, cytological studies, botanical work, study of rootsystem, investigations of diseases; sereh, mosaic disease, fungus diseases.

C. A. Backer, identification of cane varieties, investigation of weed-flora in Java cane fields.

Chief of experiment garden with native staff.

2. *Section for fieldtrials, inspection work of plantation, studies in cultivation and irrigation.*

Dr. P. J. van Breemen, chief of the fieldtrialservice; theory of fieldtrials, probable error; entomological work in Aphis mayidis and Oregma lanigera.

Dr. T. A. Tengwall and C. E. van der Eyl. field inspectors, research work on problems of the cultures of cane, irrigation, seed nurseries, fertilizers; influence of climate on crop, advices for improvement of yield of plantations. Fifteen group-advisers, officers with botanical or agricultural education, are spread over the cane districts of Java, doing the daily advising work, studying agrogeology of their district, laying out and controling the fieldtrials, in close connection with the central station.

3. *Section for geology, agrogeology, meteorology.*

Mrs. C. H. van Harreveld-Lako, chemical analysis of cane soils, properties of soil, water-capacity, nitrogen retaining power of soil, soil reaction, advices on suitability of soil for cane cultivation, record on rainfall, sunshine, wind, moisture content of air.

F. Haverkamp, chief of analytical laboratory for fertilizers and soils, with native staff.

4. *Section for engineering work.*

Mill control, study of furnaces and boilers, control on steam- and fuel-consumption, advices on all machinery; making of schemes for new factories.

Ir. N. Nobel, specialist for millwork, millconstruction, fuel-economy, research in juice extraction, automatical weighing.

Ir. L. D. Teutelink, assistant.

G. E. Ferguson, chief of mill- and fuelcontrol, with native staff.

Ir. C. J. Schott consulting engineer for this section, visits to factories, control on trials in factories.

Ing. I. Hes, assistant.

Chief of drawing office with native staff.

Chief of constructionshop, with native staff.

Chief of instrumentshop with native staff.

5. *Section for chemical work.*

Studies on clarification, boilingsprocess, evaporation, exhaustion of molasses and sugars.

V. Khainovsky, researches on extraction of juice from bagasse, analysis of bagasse.

Ir. J. W. L. van Ligten, Ir. G. E. van Ness, consulting engineers, visits to factories, supervision of trials in factories.

C. Sylmans, chief of chemical control, study of factory results and molasses; with native staff.

J. G. Smits, chief of sugar laboratory, inspection and control of optical and chemical apparatus, gauging of density-weighers, balances, glasswork; with native staff. Miss M. van de Kreke, chief of analytical laboratory for molasses, limestone, lubricating oil, calory value of fuel; with native staff.

12. *EXPERIMENT STATION CHERIBON*

(Sub-division "Cheribon" of the Java-Sugar Experiment Station.)

Raised 1910 as a sub-division of the Java-Sugar Experiment Station aiming to be a centre of scientific information in West-Java, it unfolded itself in the course of years to a small, more or less independent institute, owing partly to the great distance from Pasoeroean, partly to the centralising reorganizations of the large Experiment Station.

It is supported by 14 cane-sugar factories in West-Java and intends to give information to the cane-planters in West-Java, to advance the agricultural knowledge of its area, to investigate canediseases and insect pests, to grow new cane-cross-breeds and to introduce new varieties into practice.

Dr. V. J. Koningsberger, Director; physi-

ological, agricultural and agrogeological research.

Mrs. Drs. G. Wilbrink and P. C. Bolle, pathologists. Phytopathology (f. i. "sereh," mosaic-disease and root-rot), entomology and cane-crossing.

Miss A. E. Berkhout, physical, chemical and mineralogical analysis of soils, Atterberg-figures, analysis of manures, statistics on cane-cultivation and harvest-results, meteorological observations.

13. *GENERAL EXPERIMENT STATION OF THE A. V. R. O. S.*

Medan-Deli-Sumatra

The A. V. R. O. S. is the General Association of the rubber planters of the East Coast of Sumatra, Kampong Baroe, Medan S. O. K.

This institute is helping the planters of the East Coast of Sumatra, of Atjeh and Tapanoeli with their various cultures; only tobacco culture is excluded, as a special experiment station is organized for it. The principal crops of the members of the Avros are rubber ($\pm$ 80% of the whole area of the different estates), oilpalms, coconuts, coffee, tea, sisalfibre, gambir, geta pertja, citronella grass, coca, etc.

The staff of the experiment station was reduced in the slump period of 1922, but has just been extended once more.

Director: Dr. A. W. K. de Jong; a secretary and two clerks.

1. *Botanical division.*

Chief: Dr. C. Heusser, Dr. Boudijin, Hevea selection. Experiments in the selection garden Soengei Pantjoer. Research of the cytology of flower and fruit of the oilpalm. Research work on plant diseases.

2. *Agricultural division.*

Chief: Dr. J. G. J. A. Maas; second agriculturist. Dr. J. F. Schmöle, Manuring experiments. Tapping and thinning out experiments with rubber. Oilpalm selection. Introduction of new plants. Soil treatment experiments. Roselle fibre experiments.

3. *Chemical divison.*

Chief: Ir. H. N. Blommendaal; Ir. van Harpen, W. Bertels, Analyst. Experiments with preserved latex. Research work on the preparation of rubber, palmoil and other crops.

Analysis of chemicals used in the preparation of these products; chemical analyses of manures, fertilisers; testing of prepared palmoil, rubber, etc. Testing new machinery for palmoil preparation.

14. *CENTRAL RUBBERSTATION, BUITENZORG, (JAVA).*

The Central Rubberstation is maintained by a private Association "Vereeniging Centraal Rubberstation" of which companies owning rubber estates in Java and South Sumatra are the members. The AVROS (General Assoc. of Rubber Planters on the East Coast of Sumatra) gives a subsidy, while the Netherlands Indies Association for the Rubber Trade and a number of firms and dealers also support it.

The Central Rubberstation is concerned with rubber "from the moment that the latex leaves the tree to the moment the rubber reaches the manufacturer or consumer"; it does work on rubber preparation and testing, but not on cultivation, etc.

Outline of work.

Its work consists of:

(1) General research work on rubber preparation. Properties of different types of rubber (smoked sheet, crepe, matured rubber, smoked balls, evaporated latex, etc). Different coagulants and other chemicals, their influence on the properties of the rubber. Coagulation phenomena. Preservation of latex. Influence of all possible factors of the tree (age of tree, tapping system, etc.) and in preparation (coagulation, rolling, drying, etc.) on the composition and properties of the rubber. Experiments on methods of packing (matpacking, etc.)

(2) General research work on the testing of crude rubber. Development of method for testing the vulcanising properties, viscosity, plasticity, etc., in cooperation with chemists on the manufacturing side. The Central Rubberstation entertains a lively correspondence with rubber chemists in Europe and takes an active part in the work of the Testing and other Committees of the Rubber Division of the American Chemical Society.

(3) Testing work. Routine testing of

rubber, in conjunction with the investigations meant, sub. (1) and (2). Testing of samples from the ordinary output of estates. Regular control of the properties and uniformity of rubber from a certain number of estates. Certificates are issued for lots of rubber from well equipped estates, which have agreed to follow the prescription for standard preparation given by the Central Rubberstation, but only if the samples taken from each lot by a wharf of other neutral body are found to fall within the specified limits of inner properties. The Central Rubberstation is the only institute in the producing countries that does routine testing work and control of output on a large scale; yearly about 2500 samples of rubber are tested, while 15,000 ringtests on the Schopper machine, 3500, viscosity determinations and numerous other determinations are made.

(4) Besides this work, which is done for the whole of the Netherlands Indies, the Central Rubberstation also does so called local advice work for West and Mid. Java (visits to and experiments on estates; advice in case of difficulties in preparation or faults in the rubber; control (by analysis) of chemicals, water, etc.; educational work by lectures, pamphlets and demonstrations; pushing of standard methods of preparation, stimulating estates to improve preparation, etc. This work is done in East Java and on the East Coast of Sumatra by the local Experimental Stations.

Staff. The European staff consists of: Dr. O. de Vries, Director; W. Spoon, Chem. Eng. Senior Chemist; Dr. R. Riebl, Chemist; Mrs. N. Beumee-Nieuwland, Chemist.

One Secretary, one assistant, one analyst, two typists. Further a staff of 13 Native laboratory assistants and helpers.

Publications.

The research work is published in the form of Communications, which appear in the Archief voor de Rubbercultuur (1917-hodie, text in Dutch and English).

A complete review on the work done here and eleswhere on the preparation and testing of crude rubber was published in book form ("Estate Rubber, its Preparation, Properties and Testing" (1920) by Dr. O. de Vries). A Report "Rubber on the Market and in the Factory" may be mentioned, while an English translation of the "Guide to the Preparation of Rubber," especially for local use in advice work, is in course of preparation.

Pamphlets, Short Communications and Circulars are issued in Dutch only, and contain preliminary results of investigations and local advice.

15. *PHYSIOLOGY FUND, BUITENZORG*

A special Fund was brought together by a number of associations, companies and individuals interested in the development of the plantation rubber industry, to carry out physiological work on the "function of the latex in Hevea Brasiliensis" so as to establish a scientific basis for tapping and other problems. The Fund, started in 1917, continued after the first five-year agreement for another three years and ends in December, 1925. From January 1, 1926, it will be combined with the Central and West-Java Rubber Stations.

Physiologist: Dr. W. Bobilioff.

Studies on the anatomy and physiology of Hevea, chemical components and physiology of latex, especially of the ferments contained in it.

The results are published in the Archief voor de Rubbercultuur in Ned. Indiö. A general record will be published also; the first part "Anatomy of Hevea brasiliensis" has appeared; the second part "Physiology of Hevea brasiliensis" is in course of preparation.

16. *PLANTATION RESEARCH DEPARTMENT OF THE UNITED STATES RUBBER PLANTATION, INC.*

KISARAN-SUMATRA (S. O. K.)

The work of the department is solely concerned with the cultivation of rubber. The main branches of the research work concern improvement of the rubber tree by generative and vegetative methods, soil treatment, diseases, and cultural methods, viz. tapping systems, thinning, etc. The work is carried in the private interests of the plantations of the United States Rubber Plantations, Inc., in Sumatra and Malaya. From time to time however, the Directors authorise the publication of results and this is invariably done in the case of work on diseases.

Staff:

Director—J. Grantham, M. A. (Cantab.), also in charge of soil investigations.

Botanist—Dr. H. S. Yates (University of California), in charge of physiological, anatomical and disease investigations.

Botanist—C. Barclay, B.A. (Cantab.), in charge of genetical investigations.

Forester—E. M. Blair, B.A. (University of California), in charge of field experiments and investigation re-tapping systems, thinning, etc.

Selection Assistant—F. W. Donkersloot, in charge of supervision of field test plots and supply of selected material to the estates.

There are in addition connected with the same company but not members of the above department the following scientists:

United States Rubber Plantation, Inc., Process Department,—W. E. Cake, M. S. (University of Michigan), Chemist in charge of rubber preparation and testing.

Hollandsch-Amerikaansche Plantage Mij.—P. E. Keuchenius, Inspector and disease specialist.

17. *SCIENTIFIC SERVICE OF THE RUBBER CULTURE MAATSCHAPPIJ AMSTERDAM*

Klein Soengei Karang, Galang, near Medan, S. O. K.

The service carries on the scientific guidance of the estates belonging to the company and studies the problems, especially connected with these estates, as well for rubber as for oilpalms. Production of superior planting material of both crops. Improvement of methods of preparation especially for palm oil.

Staff:

For the rubber: Director Dr. P. Arens (Botanist); Assistant Dr. F. Arens (Botanist).

For the oil palm: Dr. Fickendey (chemist); Ir. C. J. Vergeer (mechanical and Chemical Engineer).

Publications are not issued.

18. *GENERAL EXPERIMENT STATION FOR TEA AND RUBBER IN W. JAVA BUITENZORG*

This station includes the Rubber Experiment Station for West Java since 1922. It was started as a division of the botanical garden in 1893; in 1907 it was reorganized, but kept up as a temporary division in the department by private means, for which purpose a special association was formed. The rubber station was started in 1915.

The station studies the planting as well as the preparation of tea for the whole of Java; for rubber it limits its work to the planting in West-Java, the preparation being studied at the Central Rubber Station in Buitenzorg. The station further studies various other crops under the local conditions of West-Java.

Director: Dr. Ch. J. Bernard, Botanist; general administration and superintendence of the personnel. Phytopathology, especially disease of the tea plant caused by fungi and mites.

Sub-Director Dr. J. J. B. Deuss, Chemist, Composition of tea leaf; characters and components of tea. Preparation of tea; examination of its quality. Soil research (chemical and mechanical). Manuring and fertilizers.

Botanist: Dr. C. P. Cohen Stuart. Botanical characters of tea plant. Breeding of tea; seed selection; pruning, picking.

Entomologist: Dr. R. Menzel. Diseases of tea and rubber; caused by insects; especially Helopeltis. Natural enemies of insect pests. Pests of Cinchona. Coffee berryborer (boeboek) in West-Java.

Botanist: Dr. A. Steinmann. Botanical characters of rubber. Breeding, budding, tapping and especially diseases of Hevea.

Agronomist: A. J. Garretsen. Advices on tea estates; upkeep; manuring (acidity of the soil), picking, pruning, preparation; especially fighting of the Helopeltis-pest.

Agronomist: A. A. M. N. Keuchenius. Adviser on tea estates, especially planthreeding, grafting, laying out of seedgardens; greenmanurers.

Agronomist: G. F. van der Meulen. Adviser on rubber estates; manuring and green manuring, diseases and tapping. Experiment field Tjiomas. Experiments with Hibiscus sabdariffa (Fibre roselle).

Publications are:

1. Mededeelingen van het Algemeen Proefstation voor Thee.
2. "De Thee," a periodical appearing quarterly, with short notes about tea.
3. Mededeelingen van het West Java Rubberproefstation (also published in the Rubber archief).

RUBBER PROEFSTATION WEST-JAVA (RUBBER EXPERIMENT STATION WEST-JAVA).

The Association "Rubberproefstation West-Java" has its members amongst rubber estates in the Western half of Java and in South Sumatra. From the 1st of January, 1926, it will be combined with the Central Rubber station.

Its work consists of all questions relating to soil, cultivation, manuring, planting, diseases and tapping, and further agricultural, botanical and physiological work connected with Hevea brasiliensis. General research on these subjects is carried out, in so far as it is not cared for by the special divisions of the Department of Agriculture, or delegated to divisions of the other Experimental Stations; this research work takes place in close cooperation with the Experimental Stations in East Java which treat the questions connected with special local circumstances (rubber interplanted with coffee; prolonged dry monsoon in East Java, etc.).

This work includes a study and comparison of different green manures; field experiments on manuring, thinning out, tapping systems; research on different diseases; physiological research, etc.

Besides this work of a general nature the Station has to look after the advice work and local work in West-Java (visits to estates, examination of samples and reports thereon, lectures and other work of an educational nature, etc.).

The staff consists of one Botanist and two Agriculturists with helpers and native staff.

Publications appear in the Archief voor de Rubbercultuur, in local papers and in the form of circulars, pamphlets, etc. Special mention may be made of the Handbook "Diseases of Hevea Brasiliensis" by Dr. A. Steinmann, of which an English edition is now in the course of preparation. A "Handbook for the Rubber Culture in the Netherlands Indies" (in Dutch) was published, in conjunction with the other Rubber Experimental Stations, in 1920.

19. *EXPERIMENT STATION FOR TEA MALABAR*

Situated at the Malabar Estate, Pengalengan near Bandoeng

Director: K. A. R. Bosscha.

Chemist:

Plant breeding with tea and cinchona.

Field experiments with artificial fertilizers and green manures for tea and Cinchona.

Research work on a process to prepare chinine and kina-salts out of the fresh met bark.

Daily control of the preparation of tea for the market in the laboratory.

20. *EXPERIMENT STATION FOR CENTRAL JAVA SALATIGA*

This station studies the conditions for the various crops produced in Central Java, in collaboration with the technical staff of the Tea and Rubber station in Buitenzorg and the coffee station in Malang.

Director: (acting) Dr. Ch. J. Bernard.

Agronomist: J. Th de Haan.

Visits to estates and advice work on cacoa, kapok, coffee, rubber, manuring and green manuring.

21. *EXPERIMENT STATION MALANG, MALANG.*

This institution aims at the improvement of the plantations of permanent crops (exclus. tea and cinchona) in the provinces Madioen, Kediri, Pasoeroean, Soerbaja; the principal crops there are coffee and rubber; while coca is also of some importance.

The staff comprises:
Director: Dr. A. J. Ultee, Chemist.
Botanist: Dr. W. Bally.
Agronomist: Th. G. E. Hoedt.
The expenses are met by subscriptions of the members (coffee and rubber estates).
The station has its own building at Malang, with library, laboratories and experiment garden at 2 H.A.; while it owns also a seed production garden of 80 H.A.

Its work may be described as threefold:

(1) Educational, carried out by lecturing before planters' meetings.
(2) Advisory, by publications, circulars, oral and written advices and especially visits to estates.
(3) Scientific, by research work on its laboratories, experiment gardens and field tests on estates for coffee and rubber on: diseases and pests, selection (by seed and by vegetative multiplication) manuring (especially green manuring); preparation for the market; tapping experiments with rubber.

The results are published, for rubber in the "Archief voor de Rubbercultuur" and for coffee in the "Archief voor de koffiecultuur"; further a yearly report is published and records of the lectures may be found in the minutes of the meetings.

22. *LABORATORY FOR THE STUDY OF THE BEETLEBORER OF COFFEE BERRIES, MALANG.*

In 1921 an insect pest, already known since 1909, Stephanoderes hampei Ferr. took such proportions that special funds were raised by the coffee producing companies for starting research work on methods to fight it. The laboratory is housed in the Experiment station building at Malang.

Entomologist: Dr. H. Begemann.

Various methods of fighting the pest by estate methods and by parasites (Prorops nasuta Waterst.) are studied. Publications: Mededeelingen van het Koffiebessenboeboekfonds.

24. *EXPERIMENT STATION FOR TOBACCO AT KLATEN.*

The Station is maintained by an association formed for this special purpose by the owners of the large plantations in the Central Javanese native states (Djokjakarta and Soerakarta).

It does scientific research work in the interest of the tobaccoculture in Soerakarta and Djocjakarta and gives advice on this subject to its members.

All tobacco plantations in the region mentioned above are members.

The personnel comprises:
Director: Dr. A. d'Angremond.
Agriculturist: A. N. J. Beets.
Agriculturist: P. M. Bartels.
Analyst: E. J. Her.
Assistants: T. E. van Wijlen, J. F. Haenzgen, Jagoos, M. G. Gervais.
The staff comprises further 35 Javanese laboratory helpers.
The projects comprise:
Dr. A. d'Angremond: (1) Research work on breeding; (2) Fighting Phytophthora Nicotianae Br. de Haan; (3) Fighting Oidium of tobacco.
A. N. J. Beets: (1) Research work on drying and fermentation; (2) Manuring experiments; (3) Research on the combustibility of tobacco.
P. M. Bartels: Research on the problem during which number of years stable manure can be replaced by artificial fertilizer without causing a going down of the quantity or quality of the tobacco.

25. *DELI EXPERIMENT STATION* (for tobacco)

The station is working in the interest of the Sumatra Tobacco cultivation and maintained by the Deli Planters Vereeniging formed by the tobacco companies.

Director: Dr. B. T. Palm (General direction and advice service).
Secretary: C. H. ten Cate (office work and library).
Division of Chemistry: Ir. E .Sidenhuis. Experiments on drying and fermentation of tobacco. Soil analyses.
B. Ph. M. de Groot, 2nd chemist. Analyses of samples of fertilizers, insecticides, etc.
Division of Botany: Dr. S. C. J. Jochems. Plantbreeding and phytopathological work with tobacco.
A. R. R. F. Koelen, Assistant. Breeding experiments.
Division of Agronomy: Ir. E. Sidenius. Experiments on manuring, draining, green manuring, crop rotation.
Ir. van der Poel, 2nd Agronomist.
R. Noerngali, Field assistant.
Division of Zoology: Dr. L. Fulmek. Fighting caterpillars in the field and the sheds; fighting lice. Biological researches in connection with the jungle on tobacco soils.
J. C. van der Meer Mohr, 2nd Zoologist.